

1. (original) An aqueous bath composition for the electroless deposition of copper molybdenum, comprising, in addition to water:
  - a soluble source of copper ions;
  - a soluble source of molybdenum ions; and
  - a reducing agent comprising boron;wherein said composition is adapted to electrolessly produce a copper molybdenum deposit having a resistivity of less than 30 microhm.cm.
2. (original) A composition according to claim 1, wherein said copper molybdenum deposit has a resistivity of less than 10 microhm.cm.
3. (original) A composition according to claim 1, wherein said composition is substantially devoid of alkali metals and alkaline earth metals.
4. (original) A composition according to claim 1, wherein said soluble source of copper ions comprises copper sulfate.
5. (original) A composition according to claim 4, wherein said copper sulfate comprises copper sulfate pentahydrate ( $\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$ ) at a concentration of 2-10 g/l.
6. (original) A composition according to claim 5, wherein said copper sulfate pentahydrate is at a concentration of 3-5 g/l.
7. (original) A composition according to claim 1, wherein said soluble source of molybdenum ions comprises molybdic acid monohydrate ( $\text{H}_2\text{MoO}_4 \cdot \text{H}_2\text{O}$ ).
8. (original) A composition according to claim 7, wherein said molybdic acid monohydrate is present at a concentration of 0-5 g/l.

9. (original) A composition according to claim 8, wherein said molybdic acid monohydrate is present at a concentration of 1.5-3 g/l.
10. (original) A composition according to claim 1, wherein the reducing agent is selected from sodium borohydride, potassium borohydride, borane pyridine complex and a borazane selected from dimethylamineborane (DMAB), borane triethylamine (TEAB), DMAB-complex and TEAB-complex.
11. (original) A composition according to claim 10, wherein said borazane is of the formula  $R_xNH_y \cdot BH_{(x+y)}$ ,  
wherein x is an integer between 0 and 3,  
wherein y is an integer between 0 and 3, and  
wherein R is an organic group selected from methyl and ethyl
12. (original) A composition according to claim 10, wherein the reducing agent comprises dimethylamineborane.
13. (original) A composition according to claim 12, wherein the reducing agent comprises a dimethylamineborane.complex.
14. (original) A composition according to claim 13, wherein said dimethylamineborane complex is present at a concentration of 5-20 g/l.
15. (original) A composition according to claim 14, wherein said dimethylamineborane complex is present at a concentration of 7-12 g/l.
16. (original) A composition according to claim 11, further comprising tetra-methyl ammonium hydroxide (TMAH) at a concentration of 50-100 g/l.

17. (original) A composition according to claim 1, further comprising ammonium hydroxide.
18. (original) A composition according to claim 17, wherein said ammonium hydroxide is at a concentration of less than 20 ml/l.
19. (original) A composition according to claim 1, wherein the pH is between 8-12.
20. (original) A composition according to claim 19, wherein the pH is between 9-11.
21. (original) A composition according to claim 1, wherein said composition is adapted to produce a copper molybdenum deposit having at least one of the following properties:
- (i) a change in reliability as defined by mean-time- to-failure during electro-migration testing of more than a factor of ten;
  - (ii) a void density of less than  $0.5/\text{cm}^2$ ;
  - (iii) a grain boundary diffusion coefficient of less than  $10^{-8.3} \cdot e^{-1.25\text{eV}/kT}$ ;
  - (iv) a grain boundary diffusion coefficient,  $D_0$  of  $10^{-8.3} \text{ cm}^2/\text{s}$ ; and
  - (v) a distribution of grain sizes having a standard deviation of less than 3 nm.
22. (original) A composition according to claim 1, wherein said composition is adapted to electrolessly deposit copper molybdenum at a temperature of less than 60 °C.
23. (original) A composition according to claim 22, wherein said composition is adapted to electrolessly deposit copper molybdenum at a temperature of between 40 °C to about 50 °C.

24. (original) A composition according to claim 1, further comprising a surfactant.
25. (original) A composition according to claim 24, wherein said surfactant comprises at least one of RE-610 and Triton X-100.
26. (original) An aqueous bath composition for the electroless deposition of copper molybdenum, comprising, in addition to water:
- a soluble source of copper ions;
  - a soluble source of molybdenum ions;
  - a soluble source of citrate ions; and
  - a reducing agent comprising boron; and
- wherein said composition is adapted to electrolessly produce a copper molybdenum deposit having a resistivity of less than 300 microhm.cm.
27. (original) A composition according to claim 26, wherein said soluble source of citrate ions comprises sodium citrate.
28. (original) A composition according to claim 26, wherein said copper molybdenum deposit has a resistivity of less than 100 microhm.cm.
29. (original) A composition according to claim 26, wherein said composition is substantially devoid of alkali metals and alkaline earth metals.
30. (original) A composition according to claim 25, wherein said soluble source of copper ions comprises copper sulfate.
31. (original) A composition according to claim 30, wherein said copper sulfate comprises copper sulfate pentahydrate ( $\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$ ) at a concentration of 2-10 g/l.

32. (original) A composition according to claim 31, wherein said copper sulfate pentahydrate is at a concentration of 3-5 g/l.

33. (original) A composition according to claim 26, wherein said source of molybdenum comprises molybdic acid monohydrate( $\text{H}_2\text{MoO}_4 \cdot \text{H}_2\text{O}$ ).

34. (original) A composition according to claim 33, wherein said molybdic acid monohydrate is present at a concentration of 0-5 g/l.

35. (original) A composition according to claim 34, wherein said molybdic acid monohydrate is present at a concentration of 1.5-3 g/l.

36. (original) A composition according to claim 26, wherein the reducing agent is selected from dimethylamineborane (DMAB), sodium hydroborate, potassium hydroborate, sodium borohydride, potassium borohydride, a borazane, and borane pyridine complex.

37. (original) A composition according to claim 36, wherein said borazane is of the formula  $\text{R}_x\text{NH}_y \cdot \text{BH}_{(x+y)}$ ,

wherein x is an integer between 0 and 3,

wherein y is an integer between 0 and 3, and

wherein R is an organic group selected from methyl and ethyl

38. (original) A composition according to claim 26, wherein the reducing agent comprises dimethylamineborane.

39. (original) A composition according to claim 38, wherein the reducing agent comprises a dimethylamineborane complex.

40. (original) A composition according to claim 39, wherein said dimethylamineborane complex is present at a concentration of 5-20 g/l.
41. (original) A composition according to claim 39, wherein said dimethylamineborane complex is present at a concentration of 7-12 g/l.
42. (original) A composition according to claim 26, further comprising tetra-methyl ammonium hydroxide (TMAH) at a concentration of 50-100 g/l.
43. (original) A composition according to claim 26, further comprising ammonium hydroxide.
44. (original) A composition according to claim 43, wherein said ammonium hydroxide is at a concentration of less than 20 ml/l.
45. (original) A composition according to claim 26, wherein the pH is between 8-12.
46. (original) A composition according to claim 45, wherein the pH is between 9-11.
47. (original) A composition according to claim 26, wherein said composition is adapted to produce a copper molybdenum deposit having at least one of the following properties:
- (i) a change in reliability as defined by mean-time- to-failure during electro-migration testing of more than a factor of ten;
  - (ii) a void density of less than  $0.5/\text{cm}^2$ ;
  - (iii) a grain boundary diffusion coefficient of less than  $10^{-8.3} \cdot e^{-1.25\text{eV}/kT}$ ;
  - (iv) a grain boundary diffusion coefficient,  $D_o$  of  $10^{-8.3} \text{ cm/s}$ ; and

(v) a distribution of grain sizes having a standard deviation of less than 3 nm.

48. (original) A composition according to claim 26, wherein said composition is adapted to electrolessly deposit copper molybdenum at a temperature of less than 60 °C.

49. (original) A composition according to claim 48, wherein said composition is adapted to electrolessly deposit copper molybdenum at a temperature of between 40 °C to about 50 °C.

50. (original) A composition according to claim 26, further comprising a surfactant.

51. (currently amended) [[50]] A composition according to claim 50, wherein said surfactant comprises at least one of RE-610 and Triton X-100.

52. (currently amended) [[51]] A copper molybdenum film electrolessly deposited on a surface from a bath comprising the composition according to claim 1, and wherein a resistivity of said film is less than 10 microOhm.cm.

53. (currently amended) [[52]] A film according to claim 52 [[51]] wherein the thickness of said film is less than approximately one micron.

54. (currently amended) [[53]] A film according to claim 52, wherein the thickness of said film is less than approximately 0.1 micron.

55. (currently amended) [[54]] A film according to claim 52, [[51]] wherein a resistivity of said film is less than 8 microOhm.cm.

56. (currently amended) [[55]] A film according to claim 52, [[51]] wherein said film comprises 0-3% molybdenum.

57. (currently amended) [[56]] A film according to claim 56, [[55]] wherein said film comprises 1-3% molybdenum.

58. (currently amended) [[57]] A film according to claim 52, [[51]] wherein said film acts as a diffusion barrier for a metal on said surface; wherein said metal is selected from copper, gold, platinum, palladium, silver, nickel, cadmium, indium and aluminum.

59. (currently amended) [[58]] A film according to claim 52, [[51]] wherein said film acts as an oxidation barrier.

60. (currently amended) [[59]] A film according to claim 52, [[51]] wherein said film acts as a corrosion barrier.

61. (currently amended) [[60]] A copper molybdenum film electrolessly deposited on a surface from a bath comprising the composition according to claim 26, and wherein a resistivity of said film is less than 300 microOhm.cm.

62. (currently amended) [[61]] A film according to claim 61, [[60]] wherein the thickness of said film is less than approximately one micron.

63. (currently amended) [[62]] A film according to claim 62, [[61]] wherein the thickness of said film is less than approximately 0.1 micron.

64. (currently amended) [[63]] A film according to claim 61, [[60]] wherein a resistivity of said film is less than 100 microOhm.cm.



65. (currently amended) [[64]] A film according to claim 61, [[60]] wherein a resistivity of said film is less than 10 microOhm.cm.

66. (currently amended) [[65]] A film according to claim 61, [[60]] wherein said film comprises 0-3% molybdenum.

67. (currently amended) [[66]] A film according to claim 61, [[60]] wherein said film comprises 1-3% molybdenum.

68. (currently amended) [[67]] A film according to claim 61, [[60]] wherein said film acts as a diffusion barrier for a metal on said surface; wherein said metal is selected from copper, gold, platinum, palladium, silver, nickel, cadmium, indium and aluminum.

69. (currently amended) [[68]] A film according to claim 61, [[60]] wherein said film acts as an oxidation barrier.

70. (currently amended) [[69]] A film according to claim 61, [[60]] wherein said film acts as a corrosion barrier.

71. (currently amended) [[70]] A method for the electroless deposition of copper molybdenum on a surface, comprising:

electrolessly depositing copper molybdenum on said surface, substantially in the absence of alkali metal ions so as to produce a copper molybdenum layer having a resistivity of less than 300 microohm.cm.

72. (currently amended) [[71]] A method according to claim 71, [[70]] wherein said resistivity is less than 100 microohm.cm.

73. (currently amended) [[72]] A method according to claim 71, [[70]] wherein said resistivity is less than 10 microohm.cm.

74. (currently amended) [[72]] A method according to claim 71, [[70]] wherein said resistivity is less than 8 microohm.cm.

75. (currently amended) [[73]] A method according to claim 71, [[70]] further comprising activating said surface, and wherein activating said surface occurs at least partially under dry process conditions.

76. (currently amended) [[74]] A method according to claim 71, [[70]] wherein said surface comprises silicon.

77. (currently amended) [[75]] A method according to claim 71, [[70]] wherein said surface comprises copper.

78. (currently amended) [[76]] A method according to claim 71, [[70]] wherein activating said surface further comprises depositing at least one metal on said surface.

79. (currently amended) [[77]] A method according to claim 78, [[76]] wherein said at least one metal is selected from aluminum, cobalt, copper and titanium.

80. (currently amended) [[78]] A method according to claim 78, [[76]] and further comprising removing at least partially some of said at least one metal.

81. (currently amended) [[79]] A method according to claim 71, [[70]] further comprising activating said surface, and wherein activating said surface occurs, at least partially, under wet process conditions.

82. (currently amended) [[80]] A method according to claim 81, [[74]] wherein activating said surface comprises at least one of the following steps:

(a) degreasing said surface;

(b) removing at least one oxide from said surface;

(c) fluoride etching said surface;

(d) rinsing said surface;

(e) activating said surface with palladium; and

(f) pre-dipping said surface in a solution comprising at least one of a reducing agent and a complexing agent.

83. (currently amended) [[81]] A method according to claim 71, [[70]] wherein said surface comprises silicon.

84. (currently amended) [[82]] A method according to claim 83, [[81]] wherein said surface comprises copper.

85. (currently amended) [[83]] A method according to claim 71, [[70]] wherein electrolessly depositing comprises electrolessly depositing a film having a thickness of less than approximately one micron.

86. (currently amended) [[84]] A method according to claim 85, [[83]] wherein the thickness of said film is less than approximately 0.1 micron.

87. (currently amended) [[85]] A method according to claim 71, [[70]] wherein said film comprises 0-3 % molybdenum.

88. (currently amended) [[86]] A method according to claim 71, [[70]] wherein depositing said copper molybdenum is at a temperature of less than 60°C.

89. (currently amended) [[87]] A method according to claim 88, [[86]] said temperature is from around 40°C to 50°C.

90. (currently amended) [[88]] A method according to claim 89, [[87]] wherein depositing said copper molybdenum occurs at a pH of around 9 up to 11.

91. (currently amended) [[89]] A method according to claim 90, [[88]] wherein said pH is around 9.5 to 10.5.

92. (currently amended) [[90]] A method for the electroless deposition of copper molybdenum on a surface, comprising:

electrolessly depositing copper molybdenum on said surface in the presence of citrate ions so as to produce a copper molybdenum layer having a resistivity of less than 300 microhm.cm.